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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/919,699	07/31/2001	Donald J. Milligan	10006051-1	5384

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EXAMINER	
NGUYEN, LAM S	

ART UNIT	PAPER NUMBER
2853	

DATE MAILED: 04/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Offic Action Summary	Application No.	Applicant(s)	
	09/919,699	MILLIGAN ET AL.	
	Examiner	Art Unit	
	LAM S NGUYEN	2853	

-- The MAILING DATE of this c mmunication appears on the cover sheet with the correspondenc address --

Peri d for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 April 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disp sition of Claims

4)☒ Claim(s) *15-49* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *30 and 44-49* is/are allowed.

6)☒ Claim(s) *15-29,31 and 34* is/are rejected.

7)☒ Claim(s) *32,33 and 35-43* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *31 July 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 15-20, 28-29, 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murthy et al. (US 5658471) in view of Mantell et al. (US 5867192).

Murthy et al. disclose a fluid ejecting device comprising:

a silicon substrate having <100> crystalline orientation (FIG. 1G, element 2, and column 1, line 44-45),

a plurality of fluid/ink drop generators (FIG. 1G) formed on a first surface of said silicon substrate,

a fluid/ink feed slot extending from a second surface of said silicon substrate to said first surface (FIG. 1G, element 20) having an opening at the first surface having a width W1 (FIG. 4B, element 48) that is less than a width W2 (FIG. 4B, element 46) of an opening at the second surface.

Murthy et al. do not disclose that said fluid slot formed by deep reactive ion etching followed by anisotropic wet etching.

However, Mantel et al. disclose a process of making cavities in a silicon substrate having <100> crystalline orientation wherein the cavities are formed by deep reactive ion etching process followed by anisotropic wet etching process (column 3, line 43 to column 4, line 23).

Therefore, it would have been obvious for one having ordinary skill in the art at the time the invention was made to form the ink feed slots in the printhead disclosed by Murthy et al. by the process of the deep reactive ion etching followed by anisotropic wet etching as disclosed Mantell et al. The motivation of doing so is that the advantage of the reactive ion etching is easily reproducible and the wet etching process is self-terminating, this is convenient for mass production as taught by Mantell et al. (column 3, line 46-48 and column 4, line 5-10).

Murthy et al. also disclose the following claimed invention:

Referring to claims 16, 19, 31: wherein W1 is about 100 micrometers or less (column 8, line 45-50).

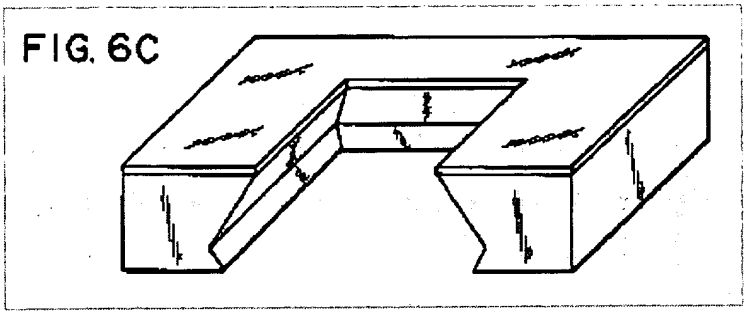
Referring to claims 17, 20, 31: wherein W2 is about 300 micrometers or less (column 8, line 45-50).

2. Claims 21-27, 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murthy et al. (US 5658471) in view of Mantell et al. (US 5867192) and further in view of Yagi et al. (US 6143190).

Murthy et al., as modified, disclose the claimed invention as discussed above, except wherein the fluid feed slot has a diamond shape (**Referring to claims 21, 24**), the fluid feed slot has a width at a location intermediate the first surface and the second surface which is larger than width W1 (**referring to claims 22, 25, 27**), wherein a longitudinal extent of the fluid feed slot is aligned with a <100> plane of the substrate (**Referring to claims 23 and 26**), and wherein the substrate has a thickness of about 675 micrometers or less (**Referring to claim 34**).

Yagi et al. disclose a method of producing a through-hole, silicon substrate having a thickness of 525 micrometers (column 10, line 55-58) and to form a fluid feed shot (in term of "a

through-hole serving as an ink supplying hole" (column 27, line 4-6) in a <100> silicon wafer (column 12, line 33-34) in a diamond shape (FIG. 6C) with a width at a location intermediate the first surface and the second surface which is larger than width W1 (FIG. 6C), and wherein a longitudinal extent of the fluid feed slot is aligned with a <100> plane of the substrate (FIG. 6C).



Therefore, it would have been obvious for one having ordinary skill in the art at the time the invention was made to modify the shape of the ink feed slots in the printhead disclosed by Murthy et al., as modified, as a diamond having a width at a location intermediate the first surface and the second surface larger than width W1 as disclosed by Yagi et al. The motivation of doing so is to control the fluid conductance to a desired value, which could not be achieved by the conventional technique, as taught by Yagi et al. (column 12, line 20-28).

Allowable Subject Matter

3. Claims 30, 44-49 are allowed and Claims 32, 33, 35-43 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Referring to claims 30, 32, 35: The most pertinent art fails to disclose wherein said fluid slot formed by deep reactive ion etching to a depth of at least one-half a thickness of the silicon substrate followed by anisotropic wet etching. Therefore, the claimed invention is not disclosed by the cited prior art.

Referring to claims 33, 36: The most pertinent art fails to disclose wherein said fluid slot formed by deep reactive ion etching to a depth of at least about 475 micrometers. Therefore, the claimed invention is not disclosed by the cited prior art.

Referring to claims 38 and 44: The most pertinent art fails to disclose wherein:

$$W1 \simeq W2 + 2(DD*\tan\alpha + (DD - STH/\tan(54.7deg)))$$

Wherein: STH is the thickness of the substrate

DD is a depth caused by the deep reactive ion etching process

α is an angle of re-entrancy

W1 and W2 are the openings at the first and second surfaces.

Therefore, the claimed invention is not disclosed by the cited prior art.

Claims 37, 39-43 and 45-49 are also allowed because they depend directly/indirectly on claim 35, 38 or 44.

Response to Arguments

Applicant's arguments filed 04/05/2004 have been fully considered but they are not persuasive.

Regarding to the argument on page 4: The applicants argued that Mantell does not disclose, teach, or suggest "a fluid feed slot extending from a second surface of said silicon substrate to said first surface". The examiner does not agree with this argument. Even though, Mantell's process creates the cavity having an ultimate depth in this particular application, the teaching does not limit the extension of its application. In deed, the final depth of the cavity is controllable and dependent on the depth of the reactive ion etch and the width of the opening in the mask (column 4, line 14-17). Therefore, it is up to a particular application to predetermine

the depth of the reactive ion etch and the width of the opening in the mask in order to have a desired final depth. As a result, in order to create "a fluid feed slot extending from a second surface of said silicon substrate to said first surface", one just needs to set the depth of the reactive ion etch and the width of the opening in the mask such that the final depth is at least or greater than the thickness of the substrate.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LAM S NGUYEN whose telephone number is (571)272-2151. The examiner can normally be reached on 7:00AM - 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, STEPHEN D MEIER can be reached on (571)272-2149. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LN
April 15, 2004

Hai Phan

HAI PHAM
PRIMARY EXAMINER